



DK32 - DK34 Supplementary Instructions

Variable area flowmeter with electrical built-ins

Equipment protection by non-sparking Ex nA



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1.1 General notes

These supplementary instructions apply to explosion-proof versions of the variable area flowmeters with electrical built-ins and the marking Ex nA. It completes the standard documentation for the non-explosion-proof versions.

The information given in these instructions contains only the data relevant to explosion protection. The technical details given in the standard instructions for the non-explosion-proof versions apply unchanged unless excluded or superseded by these supplementary instructions.

1.2 NEPSI conformity

Variable area flowmeters, type DK32 series and DK34 series have been approved by NEPSI (National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation). This product is in accordance with the following standards:

- GB 3836.1-2010 Explosive atmospheres - Part 1: Equipment - General requirements
- GB 3836.8-2014 Explosive atmospheres - Part 8: Equipment protection by type of protection "n"

The certificate number is:

GYB20.2472X

This certification together with its boundary conditions is required to be observed without fail.



INFORMATION!

*The Ex marking is **NOT** according to the ATEX directive. Placing the product on the market of the EU for purpose of distribution and/or use in the EU is **NOT** permitted.*

1.3 Approval according to the IECEx scheme

Conformity with IECEx standards was tested in accordance with the "IECEx Certification Scheme for Explosive Atmospheres" according to IEC 60079-0:2017, IEC 60079-7:2015, IEC 60079-15:2010 and IEC 60079-31:2013.

The number of the IEC certificate is:

IECEx KIWA 18.0007X

1.4 Safety instructions

If these instructions are not followed, there is a risk of explosion.

Assembly, installation, start-up and maintenance may only be performed by **personnel trained in explosion protection!**



CAUTION!

The operator or his agent is responsible for observing any additional standards, directives or laws if required due to operating conditions or place of installation.

This applies in particular to the use of easily detachable process connections when measuring flammable media.



CAUTION!

When an equipment fault is detected the device shall be de-energised and send back to the manufacturer for repair.

2.1 Device description

Variable area flowmeters measure and display the flow of flammable and non-flammable gases and liquids. Depending on the device version, one or two individually adjustable electrical limit switch contacts can be installed in the indication unit.

The indication unit can also be equipped with a 4...20 mA signal output with HART® communication.

2.2 Description code

The safety description code consists of the following elements *:

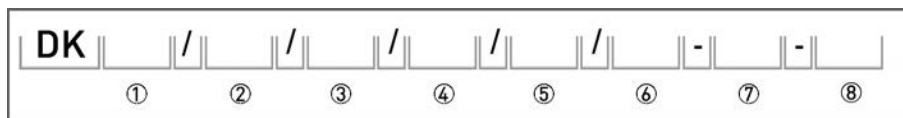


Figure 2-1: Safety description code

- ① 32 - with valve and horizontal connection
34 - without valve and vertical connection
- ② RE - flow regulator for variable inlet pressure
RA - flow regulator for variable outlet pressure
- ③ K1 - one limit switch
K2 - two limit switches
ESK - version with current output
- ④ S - plug connector
L - cable entry including cable
- ⑤ HT - high-temperature version
- ⑥ Marking without influence on the explosion safety protection
- ⑦ Ex - explosion-protected equipment
- ⑧ SK - SIL conformity according to IEC 61508 of the limit switch

* positions which are not needed are omitted (no blank positions)

2.3 Marking

The type marking of the device is realised visibly with the nameplate shown below. The interior of the display has an additional marking with the serial number (P/A).

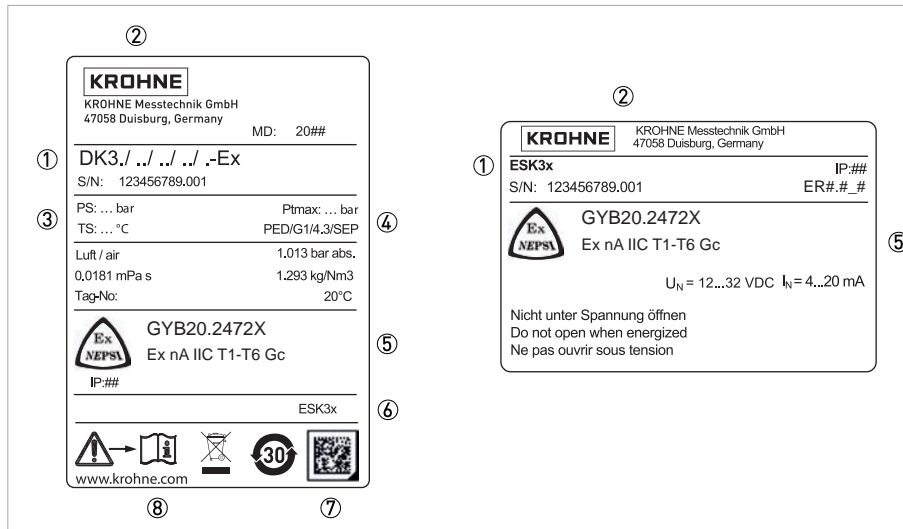


Figure 2-2: Example of a nameplate with current output

- ① Device type
- ② Manufacturer
- ③ Rating data: temperature & pressure rating
- ④ Data according to the pressure equipment directive
- ⑤ Marking according to NEPSI and permissible ambient temperature range
- ⑥ Built-in equipment
- ⑦ Data matrix
- ⑧ Safety instructions, disposal symbol and China RoHs symbol

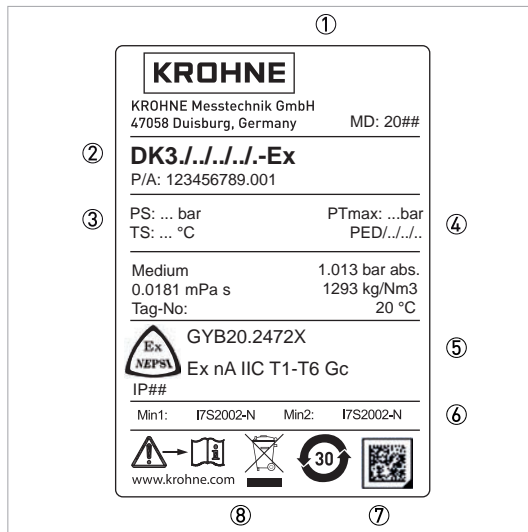


Figure 2-3: Example of a nameplate with limit switches

- ① Manufacturer
- ② Device type
- ③ Rating data: temperature & pressure rating
- ④ Data according to the pressure equipment directive
- ⑤ Marking according to NEPSI and permissible ambient temperature range
- ⑥ Built-in equipment
- ⑦ Data matrix
- ⑧ Safety instructions, disposal symbol and China RoHs symbol

2.4 Flammable products

Atmospheric conditions:

The standard atmospheric conditions under which it may be assumed that Ex equipment can be operated are:

- Temperature: -20...+60°C / -4...+140°F
- Pressure: 80...110 kPa (0.8...1.1 bar) / 11.6...15.9 psi
- Air with normal oxygen content, typically 21%v/v

Ex equipment operating outside the standard temperature range must be tested and certified (e.g. for ambient temperature range -40...+65°C / -40...+149°F).

Operation outside the specified above standard atmospheric conditions is permitted only via risk assessment of the user and additional measures, as necessary.

Operating conditions:

The measuring unit of variable area flowmeters operate outside the standard atmospheric pressure range, which means that explosion protection, regardless of the zone assignment, is fundamentally not applicable for the measuring unit (piping).



CAUTION!

Operation with flammable products is only permitted as long as no explosive fuel/air mixture builds up inside of the piping at the same time the atmospheric conditions are exceeded.

The operator is responsible to ensure that the flowmeter is operated safely in terms of the temperature and pressure of the products used. In case of operation with flammable products the measuring units must be included in the periodic pressure tests of the piping.

2.5 Device category

Variable area flowmeters are designed according to GB 3836.1-2010 and GB 3836.8-2014 for use in zone 2.

The inside of the measuring unit is also approved for zone 2.



INFORMATION!

Definition of Zone 2:

An area in which an explosive atmosphere as a result of the mixture of flammable substances in the form of gas, steam or mist with air is not expected to occur under normal operation.

If, however, such an atmosphere does occur it only lasts for a brief period of time.

2.6 Types of protection

The variable area flowmeter is designed in the type of protection non-sparking "nA".

The marking for equipment protection level Gc is:

Ex nA IIC T1-T6 Gc

The marking contains the following information:	
Ex nA	Equipment protection by type of protection "nA"
IIC	Gas group, suitable for gas groups IIC, IIB and IIA
T1-T6	Temperature class range, suitable for temperature classes T1...T6
Gc	EPL, suitable for zone 2

Table 2-1: Description of the marking

2.7 Ambient temperature / temperature classes

Due to the influence of the product temperature, no fixed temperature class is assigned to variable area flowmeters. The temperature class of these devices is rather a function of the present product temperature and ambient temperature. There is no distinction between devices with one or two contacts. The classification is outlined in the following tables.

The tables take into account the following parameters:

- Ambient temperature T_{amb}
- Product temperature T_m
- Feed power for version K. depending on the limit switches



INFORMATION!

The lowest ambient temperature for the version with limit switch of the type SC2-NO is -25°C / -13°F , for all other versions it is -40°C / -40°F .



INFORMATION!

The maximum permissible product temperatures listed in the tables are valid under the following conditions:

- The measuring device is installed and operated in accordance with the installation instructions in the standard manual.
- It must be ensured that the flowmeter is not heated by the effects of additional heat radiation (sunshine, neighbouring system components) and thus operated above the permissible ambient temperature range.
- Insulation must be limited to the piping.
Unobstructed ventilation of the indicator part must be ensured.

	Maximum permissible product temperature T_m [$^{\circ}\text{C}$]													
	T6			T5			T4				T3...T1			
Ambient temperature	40	50	55	50	65	70	40	60	65	70	40	60	65	70
DK3./../ESK/.	85	85	85	100	100 ①	90 ①	135 ①	105 ①	100 ①	90 ①	140 ①	105 ①	100 ①	90 ①

Table 2-2: DK3./../ESK/./..-Ex permissible product and ambient temperatures in $^{\circ}\text{C}$

① Heat-resistant cable and cable entry $\geq 90^{\circ}\text{C}$

	Maximum permissible product temperature T_m [$^{\circ}\text{F}$]													
	T6			T5			T4				T3...T1			
Ambient temperature	104	122	131	122	149	158	104	140	149	158	104	140	149	158
DK3./../ESK/.	185	185	185	212	212 ①	194 ①	275 ①	221 ①	212 ①	194 ①	284 ①	221 ①	212 ①	194 ①

Table 2-3: DK3./../ESK/./..-Ex permissible product and ambient temperatures in $^{\circ}\text{F}$

① Heat-resistant cable and cable entry $\geq 194^{\circ}\text{F}$

Limit switch feed power	Maximum permissible product temperature T _m [°C] with plug connector (S) or cable entry (L)															
	T6			T5			T4					T3...T1				
Ambient temperature	40	50	55	40	50	55	40	60	65	70	90	40	60	65	70	90
SC2-NO 64 mW	80	70	65	100	100	95	135	125	120 ①	120 ①	100 ①	140 ①	125 ①	120 ①	120 ①	100 ①
SC2-NO 169 mW	-	-	-	55	-	-	90	75	70	-	-	90	75	70	-	-
SJ2-SN 64 mW	80	70	70	100	100	95	135	125	120 ①	120 ①	100 ①	140 ①	125 ①	120 ①	120 ①	100 ①
SJ2-SN 169 mW	-	-	-	60	55	-	95	80	75 ①	70 ①	-	95	80	75 ①	70 ①	-
I7S2002-N 64 mW	85	80	75	100	100	100	135	125	120 ①	120 ①	100 ①	140 ①	125 ①	120 ①	120 ①	100 ①
I7S2002-N 169 mW	55	-	-	80	70	70	135	120	115 ①	110 ①	95 ①	135 ①	120 ①	115 ①	110 ①	95 ①

Table 2-4: DK3./../K./../-Ex permissible product and ambient temperatures in °C

① Heat-resistant cable and cable entry $\geq 90^\circ\text{C}$

Limit switch feed power	Maximum permissible product temperature T _m [°F] with plug connector (S) or cable entry (L)															
	T6			T5			T4					T3...T1				
Ambient temperature	104	122	131	104	122	131	104	140	149	158	194	104	140	149	158	194
SC2-NO 64 mW	176	158	149	212	212	203	275	257	248 ①	248 ①	212 ①	284 ①	257 ①	248 ①	248 ①	212 ①
SC2-NO 169 mW	-	-	-	131	-	-	194	167	158	-	-	194	167	158	-	-
SJ2-SN 64 mW	176	158	158	212	212	203	275	257	248 ①	248 ①	212 ①	284 ①	257 ①	248 ①	248 ①	212 ①
SJ2-SN 169 mW	-	-	-	140	131	-	203	176	167 ①	158 ①	-	203	176	167 ①	158 ①	-
I7S2002-N 64 mW	185	176	167	212	212	212	275	257	248 ①	248 ①	212 ①	284 ①	257 ①	248 ①	248 ①	212 ①
I7S2002-N 169 mW	131	-	-	176	158	158	275	248	239 ①	230 ①	203 ①	275 ①	248 ①	239 ①	230 ①	203 ①

Table 2-5: DK3./../K./../-Ex permissible product and ambient temperatures in °F

① Heat-resistant cable and cable entry $\geq 194^\circ\text{F}$

2.8 Electrical data

The electrical signal circuits may only be connected to separate, intrinsically safe circuits. Depending on the instrument design, the following maximum values apply per circuit:

Only for connection to separated intrinsically safe circuit according to NAMUR (IEC 60947-5-6).	
Nominal voltage U_N	8 VDC
Nominal current I_N	1...3 mA
Consult the chapter "Special conditions" when connecting (for details refer to <i>Special conditions and requirements</i> on page 14).	

Table 2-6: Version DK3../K../..-Ex

U_N	12...32 VDC
I_N	4...20 mA

Table 2-7: Version DK3../ESK../..-Ex

3.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards (e.g. IEC 60079-14 or GB/T 3836.15) by qualified personnel trained in explosion protection. The information given in the manual and the supplementary instructions must always be observed.

Variable area flowmeters must be installed in such a way that

- there is no danger from mechanical impact effects.
- there are no external forces affecting the indicator part.
- there is no mechanical load acting on the cable (e.g. strain relief).
- the device is accessible for any necessary visual inspections and can be viewed from all sides.
- the nameplate is clearly visible.
- it can be operated from a location with secure footing.



WARNING!

The DK3x/K. variable area flowmeters are only suitable for protected installation. When installing the variable area flowmeters, the operator must ensure that there is no mechanical load acting on the indicator.



CAUTION!

The manufacturer is not liable for any damage resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.



DANGER!

Components made of titanium in oxygen applications

*Variable area flowmeters with titanium components are **NOT** suitable for use in explosion-protected areas in conjunction with oxygen applications (products with an oxygen content which is significantly above the oxygen content in the earth's atmosphere)!*

3.2 Special conditions and requirements

Special conditions for safe use

Friction on the surface with coating should be avoided in case there will cause the ignition by electrostatic accumulation.

Versions with current output (type code ESK) shall only be used in an area of not more than pollution degree 2, as defined in GB/T 16935.1-2008 and shall be provided with a transient protection that is set at a level not exceeding 140% of the peak rated voltage at the supply terminals.

Versions with limit switch (type code K1 or K2) shall be prevented from solid foreign bodies falling vertically through openings into the enclosure. The device shall be installed and connected in a cabinet in such a way that the cable assembly or connection plug are protected from mechanical force.

Special requirements

- Do not open the cover in hazardous area when the device is powered.
- The cable between the product and associated apparatus should be shielded cable with insulating sheath. and the shield be grounded.
- Users are forbidden to change the configuration to ensure the explosion protection performance of the equipment. Any faults shall be settled with experts from the manufacturer.
- During installation, operation and maintenance, users shall comply with the relevant requirements of the product instruction manual,
GB3836.13-2013 "Explosive atmospheres - Part 13: Equipment repair, overhaul and reclamation",
GB/T 3836.15-2017 "Explosive atmospheres - part 15: Electrical installations design, selection and erection",
GB/T 3836.16-2017 "Explosive atmospheres - part 16: Electrical installations inspection and maintenance",
GB/T 3836.18-2017 "Explosive atmospheres - part 18:: Intrinsically safe electrical systems",
GB 15577-2018 "Safety regulations for dust explosion prevention and protection" and
GB50257-2014 "Code for construction and acceptance of electric device for explosive atmospheres and fire hazard electrical equipment installation engineering".

4.1 General notes

For version DK3./../ESK/...-Ex (current output), the signal circuits are electrically connected in the terminal compartment of the current output, for version DK3./../S/...-Ex (plug) in the terminal compartment of the plug housing and for version DK3./../L/...-Ex (connecting cable) it is the connecting cable as illustrated in the connection diagram.

Permissible maximum values (electrical data) must be observed!

Current output

The DK3./../ESK/...-Ex variable area flowmeter is equipped with a current output.

The electrical connection for the power supply and I/O functions is made in the electronics compartment of the signal converter. If no cable entry was ordered, the connection thread is simply closed with a blind plug. This must be replaced by a suitable (certified separately) M16x1.5 cable entry according to the nameplate of the ESK3x.

The cable entry guarantees protection against foreign objects and water (ingress protection) IP6x according to IEC 60529 in combination with a suitable connecting cable.

The connecting cable must be selected according to prevailing installation standards (e.g. IEC 60079-14). The outer diameter of the connecting cables must be within the sealing range of the cable entry. The connecting cable must be fixed and laid so they are sufficiently protected against damage.

Connecting cable

The DK3./../L/...-Ex variable area flowmeter is equipped with a pre-assembled connecting cable.

The connecting cable must be selected according to prevailing installation standards (e.g. IEC 60079-14). The outer diameter of the connecting cables must be within the sealing range of the cable entry. The connecting cable must be fixed and laid so they are sufficiently protected against damage.

All cores that are not used must be securely connected to the ground potential of the hazardous area or carefully insulated against each other and against ground (test voltage $\geq 500 V_{\text{eff}}$).

Cable entries / blanking plugs

The DK3./../S/...-Ex variable area flowmeter is equipped with a connector.

The connector guarantees protection against foreign objects and water (ingress protection) IP65 according to IEC 60529. The cable entry is closed with a plug. The plug is to be replaced with a suitable connecting cable (nominal diameter range 6...9 mm with a maximum nominal cross-section of 1.5 mm²).

The connecting cable must be selected according to prevailing installation standards (e.g. IEC 60079-14). The outer diameter of the connecting cable must be within the sealing range of the cable entry. The connecting cable must be fixed and laid so they are sufficiently protected against damage and mechanical load.

Connection for indicator with limit switches

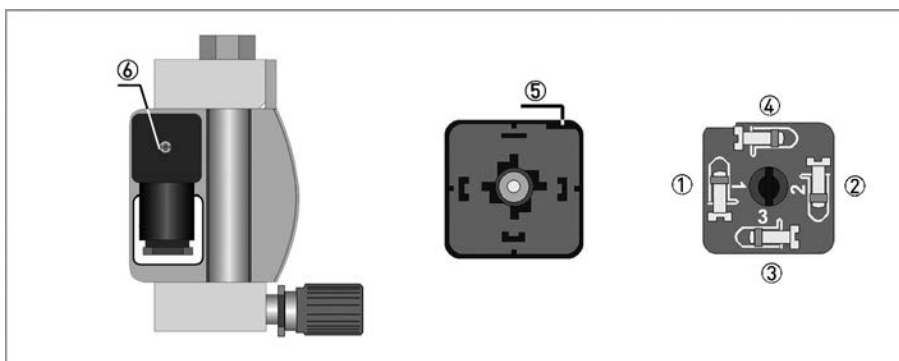


Figure 4-1: Connection for indicator with limit switches

	Contact connection	Stranded wire colour for cable assembly
①	Min minus	white
②	Min plus	yellow
③	Max minus	green
④	Max plus	brown
⑤	Lift slot	
⑥	Fastening screw of connection box	

Table 4-1: Stranded wire colour for cable assembly

Connection for indicator with current output

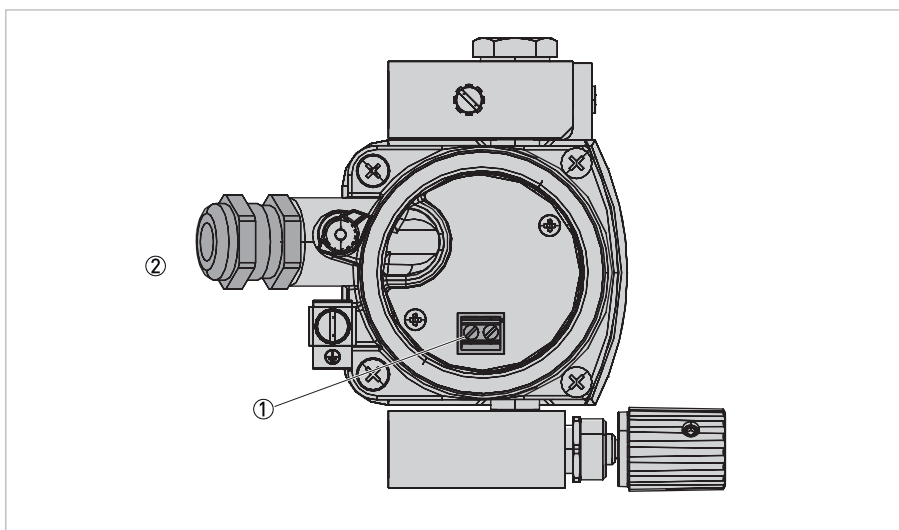


Figure 4-2: Electrical connection ESK

- ① Connection terminals
- ② Cable entry

4.2 Grounding and equipotential bonding

If the device is not sufficiently electrostatically grounded via the process pipes, an additional ground connection must be established using the ground terminal ①. The position of the ground terminal is illustrated below. The connection only ensures an electrostatic connection of the device and does not comply with the requirements of an equipotential bonding connection.

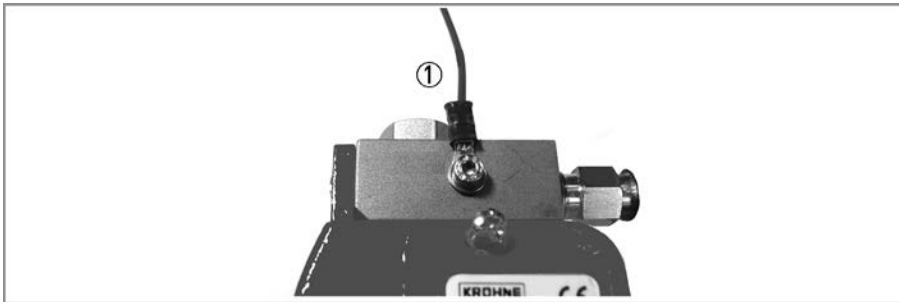


Figure 4-3: Ground terminal for DK32, DK34

For the version with current output, this can also be done at the ground terminal of the housing. The position of the ground terminal is illustrated below.

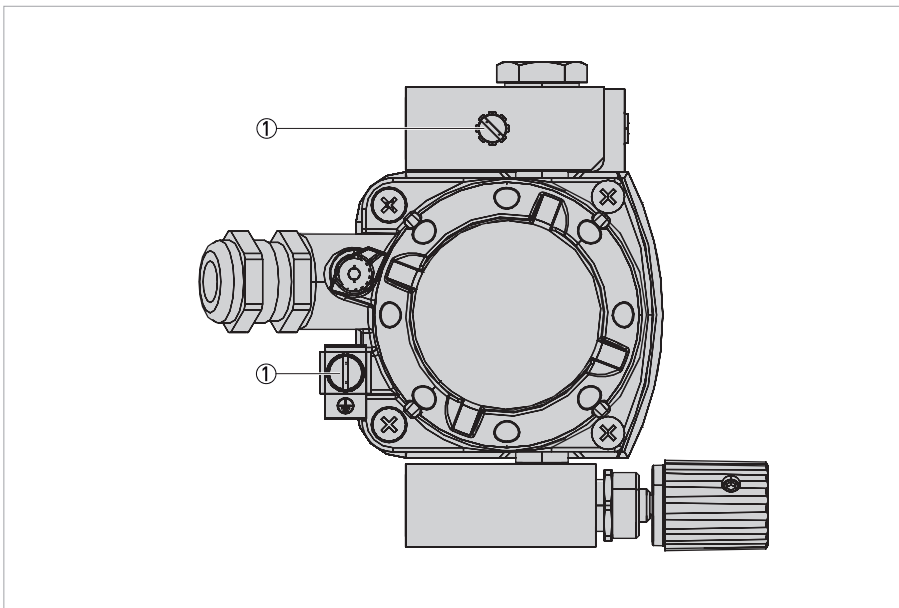


Figure 4-4: Ground terminal for ESK



INFORMATION!

The temperature at the electrostatic equalization connector on the DK32-DK34 measuring unit corresponds to the process temperature. It is thus the responsibility of the operator to select the connecting cable according to the process temperature.

5.1 Start-up

Start-up is only permitted when the variable area flowmeter:

- is correctly installed in the system and connected.
- has been checked for the proper state with regard to its installation and connection requirements.

The operator of the system has to check prior to start-up, if the start-up was in compliance with the national regulations for checks.

5.2 Operation

Variable area flowmeters must be operated in such a way that they remain within the maximum and minimum permissible temperatures and pressures and the electrical limit values.

Variable area flowmeters may only be operated if the equipment parts necessary for safety are effective in the long run, and are not rendered inoperable during operation.



CAUTION!

Ignition risks caused by pressure surges, impact or friction must particularly be avoided when titanium measuring units or floats are used.

5.3 Electrostatic charge

In order to avoid ignition hazards due to electrostatic charge, variable area flowmeters may not be used in areas with:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems).



WARNING!

*Electrostatic charging of the housing surface by friction must be avoided.
The devices must not be dry cleaned.*

6.1 Maintenance

Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.

For systems in hazardous areas, regular tests are required in order to maintain the proper condition.

The following checks are recommended:

- Check the housing, the cable entries and the feed lines for corrosion and/or damage.
- Check the NPT adapter after maintenance work, that this has not become loose on the device.
- Check the measuring unit and the piping connections for leakage.
- Check the measuring unit and the indicator for dust deposits.
- Include the flowmeter in the regular pressure test of the process line.



CAUTION!

When opening the indicator or terminal compartment, the operator must ensure there is a controlled environment that prevents dirt or similar from penetrating into the device.

Following connection or maintenance, the operator must ensure that the inside of the device is cleaned with suitable agents.

During re-assembly after maintenance of the indicator (or replacement) or the flowmeter, the operator must take appropriate measures to ensure that

- no charge is applied to the surface of the housing.
- no charge is applied to the inner surfaces of the housing.

The cover is to be closed following maintenance work on the indicator.

Cleaning of the measuring unit

Depending on the application, worst-case operating conditions may lead to reduced measuring performance as a result of fouling of the measuring system. Clean the measuring unit in accordance with the standard manual for non-explosion protected versions.

The measuring unit must be dismantled for cleaning. This dismantling will need to be coordinated with operating conditions (e.g. check for existence of a flammable liquid or explosive atmosphere in or at the tank or pressurised tank) and is within the responsibility of the operator. To do this, follow the instructions for exchanging the entire device (for details refer to *Dismantling* on page 20).

6.2 Dismantling

Replacing the display

Due to the modular design of the variable area flowmeter, from a safety perspective it is possible to replace a complete display with an identical spare part.



CAUTION!

There may be a loss of measuring accuracy!

Exchanging the entire device

The dismantling and installation is within the responsibility of the operator.

Before disconnecting the electric connecting cable of the device, make sure that all cables leading to the indication unit are isolated from the ground of the hazardous area.

This also applies to functional earth conductors (FE) and equipotential bonding conductors (PA).



CAUTION!

- *Pressurised pipes have to be depressurised before removing the measuring unit.*
- *In the case of environmentally critical or hazardous products, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.*
- *New gaskets have to be used when re-installing the device in the pipeline.*







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